

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**WETLAND RESTORATION**

(acre)

**CODE 657**

**DEFINITION**

A rehabilitation of a drained or degraded wetland where the soils, hydrology, vegetative community, and biological habitat are returned to the natural condition to the extent practicable.

**PURPOSE**

To restore hydric soil conditions, hydrologic conditions, hydrophytic plant communities, and wetland functions that occurred on the disturbed wetland site prior to modification to the extent practicable.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies only to sites with hydric soil which were natural wetlands that have been previously degraded hydrologically and/or vegetatively.

Upon completion of the restoration the site will meet the current NRCS soil, hydrology, and vegetation criteria of a wetland.

This practice is applicable only if natural hydrologic conditions can be approximated by modifying drainage and/or artificial flooding of a duration and frequency similar to natural conditions.

If the presence of hazardous waste materials in the sediment or fill is suspected, soil samples will be collected and analyzed for the presence of hazardous waste as defined by local, state, or federal authorities. Sites containing hazardous waste will not be restored under this standard.

This practice does not apply to: Wetland Enhancement (659) intended to rehabilitate a degraded wetland where specific functions and/or values are enhanced beyond original conditions; or Wetland Creation (658) for creating a wetland on a site location which historically was not a wetland or was formerly a wetland but will be replaced with a wetland type not naturally occurring on the site.

**CRITERIA**

**General**

The landowner shall obtain necessary local, state, and federal permits that apply before restoration. The soil, hydrologic, and vegetative characteristics of the site and its contributing watershed, should be documented before alteration. This can be accomplished by review of soil surveys, drainage records, historical aerial photography, records, and site investigation. Vegetation can be determined from records or existing vegetation on similar soils on nearby sites.

Water rights are assured prior to restoration if required.

Materials used for grade stabilization or water control structures will have a minimum 25-year durability in the soil, water, and climate conditions associated with the site. Fire resistant materials will be considered for exposed portions of structures where vegetation will be maintained by burning.

Hydrologic conditions, including duration, depth, and timing, are primary factors in vegetative establishment. The vegetation selected will be compatible with the planned

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hydrologic condition. The nutrient and pesticide tolerance of the species planned will be considered.

### **Criteria for Hydric Soil Conditions**

Restoration sites will be located on hydric soils.

If the hydric soil is covered by fill, sediment, spoil, or other depositional material, the material covering the hydric soil shall be removed only to the surface of the buried (or original) hydric soil.

Re-establish an approximation of the original soil microtopography.

### **Criteria for Hydrology Restoration**

A permanent water supply should be available approximating the needs of the wetlands. The hydrology of the site is defined as the rate, path, and timing of inflow and outflow, duration, frequency, and depth of flooding, ponding, or saturation.

The maximum hydrology and the overall hydraulic variability of the restored site will approximate the conditions that existed before alteration, e.g., dynamic and static water levels, soil saturation.

The standards and specifications for Dike (356) and Structure for Water Control (587) will be used as appropriate. Refer to the Engineering Field Handbook, Chapter 13, "Wetland Restoration, Enhancement, and Creation," and Chapter 6, "Structures," for additional design information. Existing drainage systems will be utilized, removed, or modified as needed to achieve the intended purpose.

### **Restoration of Hydrologic Conditions**

Hydrologic conditions of the site are defined as the volume of water stored, rate, and timing of the inflow and outflow, duration, frequency, and depth of flooding, ponding, and/or saturation. The minimum restored hydrologic conditions of

the site will support the desired functions of the restored wetland in terms of the passage, retention, or detention of water; moisture and flooding conditions for vegetation; and open water for wildlife. For greentree reservoirs and bottomland hardwood wetlands restored on prior converted cropland, flooding will begin on November 1 and floodwaters will be drained beginning February 15.

### **Surface Drainage Removal**

Where open channels were constructed to drain the wetland, the channel will be filled with soil or controlled with grade stabilization structures to restore the wetland hydrologic conditions. A water control structure may be required to manage water levels for wetland operation and maintenance. Provisions will be made to store, pass, or divert the flow from the 10-year frequency 24-hour storm so that it does not cause erosion and flooding impacts.

Where the channel serves as an outlet for upstream lands, it is necessary to meet applicable state and local laws and regulations pertaining to flooding, surface, and subsurface drainage. The channel may be blocked with earth fill without a flow control device where flow duration and rate will not cause erosion and head cutting. The minimum length of channel to be filled will be based on the hydraulic conductivity (permeability) of the soil on the site. The minimum length to be filled is 50 feet for soils with an average hydraulic conductivity of less than 0.6 inches per hour, 100 feet for 0.6 to 2 inches per hour, and 150 feet for greater than 2 inches per hour. The side slopes on channel blocks will be 3:1 or flatter.

All fill will be compacted to achieve the density of adjacent materials. The fill for the channel block will be crowned a minimum of one foot above the top of the lowest existing channel bank to account for settlement and to prevent concentrated flow over the channel.

### **Grade Stabilization Structure**

When the 10-year frequency, 24-hour duration storm flow or ground-water inflow will prevent stabilizing the site due to long duration flows or high peak discharge, the channel will be filled and stabilized with a structure that meets the criteria for Grade Stabilization Structure (410).

### **Water Control Structure**

When it is desirable to control or manipulate the water level for operation and maintenance of the wetland at an elevation different than that caused by blocking the channel, a water control device meeting the criteria of Structure for Water Control (587) will be used.

The water control structure will be installed in a manner to prevent internal soil erosion (piping) through or around the channel block.

### **Creative Borrow and Habitat Mound Construction**

Areas that have been leveled or smoothed through agricultural use, may have the natural topography and hydrology restored by creating small depressions and mounds. Excavated areas shall vary in width and depth, and shall be irregularly shaped. The excavated surfaces shall vary in depth from 6 inches to 4 feet with at least 2/3 of the areas ranging in depth from 6 to 18 inches. Mounds or ridges shall vary in height from 1 to 4 feet, 12 to 40 feet in width, 30 to 300 feet in length, and shall have a minimum side slope of 6:1.

### **Storage Volume Replacement**

Sediment deposition or other fill material will only be removed to the top of the buried hydric soil. Sediment will be removed and placed on non-wetland sites.

If the presence of hazardous waste materials in the sediment or fill is suspected, soil samples will be collected and analyzed for the presence of hazardous waste as identified by local, state, or federal authorities.

### **Embankments**

An earth embankment may be constructed to create a pool storage volume equal to that which existed prior to conversion of the site.

Embankments with an effective height of less than 6 feet will meet the criteria for Dike (356). Embankments with an effective height of greater than 6 feet will meet the criteria for Pond (378). Embankments meeting criteria for dikes will safely handle a 10-year frequency 24-hour storm at the dike design high water level.

### **Vegetation Restoration – Trees and Shrubs**

Vegetation will be restored to the approximate native species composition whenever possible. Forested wetland plantings will include a minimum of three tree and/or shrub species where appropriate. At least two of the species will be hard-mast producing species.

Site characteristics such as soil texture, soil pH, soil saturation, timing and duration of flooding, etc., will affect the choice of woody species to be restored to wetland sites. Selection of trees for use in restoration activities will be made based on planned site hydrologic conditions rather than current site conditions. The planting guide in Attachment A lists site specific soil, hydrologic, and species information for use in restoration planning. It is important to note that trees can adapt to a drier site but not to a wetter site.

Trees selected for use will be obtained from reputable sources. Local Plant sources within 150 miles in a north-south direction from the planting site will be used.

The kind of intensity of the site preparation for planting will depend upon the species planted, existing ground cover, soil type, flooding conditions, etc. Fields can be disked, burned, chemically treated, or mowed. See the standard for Forest Site Preparation (Code 490) for further guidance for this practice.

There may be a need to subsoil on soils with evident fragipans. In those cases, seed or

seedlings will be planted in or at the edge of the subsoiling furrows.

Varying degrees of cultivation or competition control may be needed for seedling establishment. This may vary from mowing or disking between rows to chemical applications. Chemicals used in any treatment must be labeled for forestry use, and the treatment must adhere to label instructions.

Cottonwood plantings used a nurse crops for hardwood seedlings will be disked the first and second growing seasons as needed. The area will be disked again prior to planting the hardwoods in the second or third year.

Tree spacings which yield 194 to 302 trees per acre will be used for restoration purposes. The spacing will be tailored to meet specific plan objectives. The minimum acceptable stand will be 125 live trees suitable for wildlife management purposes at the end of the third growing season.

Refer to the standard for Tree/Shrub Establishment (Code 612) for further tree planting guidance.

Seedlings in areas of high beaver populations may require some protection. Tree shelters can serve this purpose, or the seedlings can be top-pruned to 3 inches above the root collar at planting to make pulling of the trees more difficult for the beavers.

Using fire as a site preparation component will reduce potential rodent (rats, voles, etc.) damage to the trees and shrubs.

Areas restored with woody plants will be protected from harmful wildfire and grazing.

Care will be taken to protect planted seedlings from off-site pesticides (e.g., agricultural pesticides). Past pesticide use on the site will be evaluated to prevent residual damage to the

planted seedlings.

Establish vegetative buffers on surrounding uplands to reduce the movement of sediment and soluble and sediment-attached substances carried by runoff.

### **Vegetation Restoration – Herbaceous Species**

Refer to the standard for Conservation Cover (Code 327) for further herbaceous species planting guidance.

### **Criteria for Wetland Functions**

A functional assessment (Hydrogeomorphic approach or similar method) shall be performed on the site prior to restoration. Restoration goals and objectives shall include targeted natural wetland functions for the wetland type and the site location as determined by the functional assessment and reference site data. A post-project assessment will be performed after an adequate period to assess the success of the restoration.

## **PLANNING CONSIDERATION**

Food Security Act, Swampbuster, and Section 404 of the Clean Water Act provisions must be considered prior to providing assistance.

Consider the effect of volumes and rates of runoff, infiltration, evaporation, and transpiration on the water budget.

Evaluate the potential for a change in rates of plant growth and transpiration because of changes in the volume of available soil water.

Consider effects on downstream flows or aquifers that would affect other water uses or users.

Consider effects on wetlands or water-related resources wildlife habitats that would be associated with the practice.

Consider as a high priority those sites adjacent to existing wetlands as they increase wetland system complexity and diversity, decrease

habitat fragmentation, and ensure colonization of the site by wetland flora and fauna.

Consider linking wetlands by corridors wherever appropriate to enhance the wetland's use and colonization by the flora and fauna.

Consider the effects of varying water levels in response to potential climatic events such as wet or dry periods.

Consider changes in salt movement/concentrations in the soil resulting from hydrologic alterations.

The nutrient and pesticide tolerance of the plant species planned should be considered where known nutrient and pesticide contamination exists.

Consider effects of temperature on water resources to prevent undesired effects on aquatic and wildlife communities.

For discharge wetlands, consider upslope water/groundwater source availability.

## **PLANS AND SPECIFICATIONS**

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other documentation. Requirements for the operation and maintenance of the practice shall be incorporated into site specifications.

## **OPERATION AND MAINTENANCE**

The following actions shall be specified to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice

(maintenance):

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals to assure the wetland restoration function shall not compromise the intended purpose;

Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) shall be implemented where available and feasible.

Timing and level setting of water control structures required for the establishment of desired hydrologic conditions or for management of vegetation (for greentree reservoirs and bottomland hardwood wetlands restored on prior converted cropland, flooding will begin on November 1 and floodwaters will be drained beginning February 15).

Inspection schedule for embankments and structures for damage assessment.

Depth of sediment accumulation to be allowed before removal is required.

Management needed to maintain vegetation, including control of unwanted vegetation.

Management of cottonwoods when used as a nurse crop (harvested in year 10 during the winter and allowed to coppice, sprouts pruned in year 12, harvested in year 20 during the summer so it does not coppice).

Acceptable uses and timing of uses (ex: hunting and trapping).

Haying and livestock grazing plans so as to allow the establishment, development, and management of wetlands and associated upland vegetation.

## APPENDIX A. CHARACTERISTICS OF SELECTED TREE SPECIES SUITABLE FOR REFORESTATION OF WETLANDS.

### KEY TO FLOOD TOLERANCE:

T (tolerance) – Species are able to survive and grow on sites where soil is saturated or flooded for long periods during the growing season. Species have special adaptations for flood tolerance.

MT (moderately tolerant) – Species are able to survive saturated or flooding persists or reoccurs for several consecutive years. These species may develop some adaptations for flood tolerance.

WT (weakly tolerant) – Species are able to survive saturated or flooded soils for relatively short periods for a few days to a few weeks during the growing season; mortality is high if flooding persists longer. Species do not appear to have special adaptations for flood tolerance.

I (intolerant) – Species are not able to survive even short periods of soil saturation or flooding during the growing season. Species do not show special adaptations for flood tolerance.

KEY TO SUITABILITY: H = high suitability, M = medium, suitability, L = low suitability, I = insufficient data to determine suitability or unsuitability.

Suitability for

Common Name(s)	Soil Types(s) for Best Growth	Flood Tolerance	Time of Seed Dissem-ination	Direct Seeding	Water-Fowl Food	Deer/Turkey Food	Wood Products	Additional Information
Overcup Oak	Heavy, poorly drained clays and clay loams	MT	Sep.-Nov.	M	L	H	L	The only species that produces acorns that float when viable; this is valuable to wildlife in periods of high water. Sloughs, swamp edges, & backwater areas.
Persimmon	Poorly Drained clays and heavy loams	MT	Sep.-Dec.	I	L	H	M	A good tree to plant with Nuttall Oak. Wet flats, shallow sloughs, & swamp edges.
Green Ash	Poorly to moderately well-drained clays and loams	MT	Oct.-Nov.	I	M	L	H	A good tree to plant with Nuttall Oak. Flats or shallow sloughs.
Nuttall Oak	Heavy-drained clays and clay loams	MT	Sep.-Feb.	H	H	H	M	Best overall seeding success obtained with this species; this is especially valuable species for wildlife since its acorns fall gradually throughout the winter. Flats, low ridges, shallow sloughs, & swamp edges.

<b>Common Name(s)</b>	<b>Soil Types(s) for Best Growth</b>	<b>Flood Tolerance</b>	<b>Time of Seed Dissem-ination</b>	<b>Direct Seeding</b>	<b>Water-Fowl Food</b>	<b>Deer/Turkey Food</b>	<b>Wood Products</b>	<b>Additional Information</b>
Pin Oak	Heavy to moderately well-drained clays and clay loams	MT	Sep.-Dec.	H	H	H	L	A fairly consistent mast producer. Terraces on wet flats.
River Birch	Moderately well-drained loams	MT	May-Jun.	I	L	L	M	A good tree to plan with Sycamore.
Sycamore	Moderately well-drained loams	OK	May-Apr.	I	M	L	M	Fast growing, often provides good cavities for wood ducks, raccoons, and other wildlife.
Cottonwood	Moderately well-drained loams	WT - MT	May-Aug.	I	M	L	H	Fast-growing tree for pulp production. Planted as a nurse crop to have hardwoods planted between in the third year.
Willow Oak	Moderately well-drained silty clays and loams	WT-MT	Oct.-Dec.	H	H	H	M	A good mast producer, the only oak whose foliage is a highly preferred food for deer. Ridges & high flats.
Water Oak	Moderately well-drained silty clays and loams	WT-MT	Sep.-Nov.	H	H	H	M	A fairly consistent mast producer. Do not plant on soils with poorly drained surface conditions or somewhat poorly or poorly drained internal conditions. Ridges or silty clay flats.
Blackgum	Well-drained silts and loams	WT	Sep.-Nov.	I	I	M	M	This species is a valuable food source for a wide variety of wildlife. Ridges & high flats.

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Swamp Chestnut Oak, Cow Oak	Moderately well-drained silty clays and loams	WT	Sep.-Oct.	M	L	H	H	A good tree to plant with Cherrybark Oak, Blackgum, Shumard Oak, And White Oak. One of the more valuable timber trees. Do not plant on soils with poorly drained surface conditions or somewhat poorly drained or poorly drained internal conditions. High flats.
Sweet Pecan	Moderately well-drained loams	WT	Sep.-Dec.	M	H	H	H	Although pecans are reportedly eaten by waterfowl, they are seldom available due to a lack of flooding of pecan sites. Do not plant on soils with poorly drained surface conditions or somewhat poorly or poorly drained internal conditions.
Shumard Oak	Well-drained loams	WT	Sep.-Dec.	H	H	H	H	The only oak recommended for soils with a pH greater than 7.0. Well drained ridges.
Cherrybark Oak	Well-drained ridge soils	WT-I	Sep.-Dec.	H	H	H	H	Probably the most valuable red oak for those desiring both wildlife and timber. Do not plant on soils with poorly drained surface conditions or somewhat poorly drained or poorly internal conditions.
White Oak	Well-drained loams	WT-I	Sep.-Nov.	M	H	H	H	Limited to the northern most areas of the Lower Mississippi Valley.